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COMBUSTOR
[Nenshoki]

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[Claim(s)] /2*

[Claim 1] A combustor equipped with a fuel nozzle; said combustor characterized by providing a pipe surrounding the upstream side of the aforesaid fuel nozzle, and at the same time, filling a space between this pipe and the aforesaid fuel nozzle with an acoustic material.

[Claim 2] A combustor equipped with a fuel nozzle; said combustor characterized by installing the acoustic material on the on the inside face of a structure which forms an air flow pass for combustion surrounding this combustor.

[Claim 3] The combustor of Claim 1 or 2 wherein the aforesaid acoustic material is composed of at least one layer of aluminum matrix which is held by a porous plate.

[Detailed Specifications]

[0001]

[Technical Field of the Invention] The present invention relates to a combustor which combusts fuel by means of a gas turbine, boiler, etc.

[0002]

[Prior Art] Figure 6 is a cross section in the vicinity of a combustor in a gas turbine equipped with a conventional combustor, and accordingly, this conventional combustor will be described. In

* Claim and paragraph numbers correspond to those in the foreign text.

Figure 6, 1 is a combustor which is attached to a casing 2 of a gas turbine.

[0003] This combustor 1 comprises a fuel nozzle 3, inner tube 4, and tail tube 5. 6 is an outer tube. A bypass elbow 7 is attached to the tail tube 5. 8 denotes a bypass valve and 9 a bypass valve variable mechanism.

[0004] 10 is an air compressor. An air compressor discharge air 11 compressed herein is conducted to the casing 2 and air for combustion is introduced into the combustor 1 from the upstream side of the fuel nozzle 3 after passing around the combustor 1, as shown by the arrow.

[0005] The combustor 1 shown in Figure 6 has the above configuration. With the combustor 1, fuel supplied through the fuel nozzle 3 is combusted, and the combusted gas thereof is sent to a gas turbine 12 to drive it.

[0006] Inside the combustor 1, as above, a combustion vibration may be generated, but in a motor, such as a gas turbine, when the combustion vibration is generated within the combustor, the combustion vibration energy thereof is reflected by the interiors of the inner tube, tail tube and outer tube, to form a large vibrational energy, and fatigue damage to the combustor itself, and further, damage to the peripheral parts, such as the turbine blades, are concerns.

[0007] In the combustor illustrated in Figure 6, when a large fluctuation in pressure developed within the combustor, such as the inner tube 4 and tail tube 5, conventionally, this fluctuation was corresponded by the distribution ratio of the fuel, the air distribution in the combustor, changes in the operating parameters, such as a drop in the load, and further, by restructuring the structure of the combustor itself.

[0008]

[Problems to be Solved by the Invention] As mentioned above, with the conventional combustor, when a large fluctuation in pressure occurred, altering the operating parameters or restructuring of the combustor itself are required, but alterations in the operating range thereof and restructuring of the structure are difficult.

[0009] Consequently, it is an object of the present invention to provide a combustor constituted to freely keep the vibration from combustion from being generated without requiring an alteration in the operating parameters, keeping an alteration to the structure to a necessary minimum, and without requiring a drastic restructuring.

[0010]

[Means for Solving the Problems] To solve the aforesaid problems in the combustor equipped with a fuel nozzle, in the present invention a combustor is provided wherein the upstream side of the fuel nozzle is surrounded by a pipe, and the space between that pipe and the fuel nozzle is filled with an acoustic material.

[0011] To solve the aforesaid problems, the present invention also adopts a construction in which the acoustic material is installed on the inside face of a structure forming an air flow pass for combustion around the circumference the combustor.

[0012] With the combustor of the present invention, the combustion vibration energy is dampened by a simple means in which the acoustic material is installed around the fuel nozzle and on the inside face of an air flow pass for combustion surrounding the combustor, whereby a stable combustion region is enlarged.

[0013] It is preferable that scattering of the acoustic material be preventable by means of a porous plate by using a least one layer of the acoustic material held by the porous plate for the acoustic material adopted in the combustor according to the present invention.

[0014] For example, an acoustic material holder with a porous plate is manufactured and the inside of the holder thereof is packed with the acoustic material, whereby the holder thereof is superpositioned on several layers thereof. Thereby adjustment of the damping effects and prevention of bias and scattering of the acoustic material can be performed.

[0015] Thereby, according to the present invention, alteration of the structure also can be performed to the necessary minimum, as opposed to a conventional combustor, and moreover, it is not necessary to alter the operating parameters, and the operating range can also be enlarged.

[0016]

[Embodiments of the Invention] The combustor according to the present invention will now be described specifically on the basis of the embodiments illustrated in Figures 1 to 4. Moreover, for simplification of explanation in the following embodiments, the same reference symbols are applied to the parts having the same configuration as those of the conventional device illustrated in Figure 5.

[0017] In Figure 1, 13 is an extended pipe, which extends to the upstream side of the fuel nozzle 3 and surrounds the circumference thereof. Five layers of an acoustic material holder 16 with a porous plate 15 (Figure 3) are superpositioned and installed between the extended pipe 13 and the fuel nozzle 3. The acoustic material holder 16 is filled with an acoustic material 14.

[0018] The porous plate 15 is installed to prevent scattering of the acoustic material 14, and the acoustic material holder 16 is divided into several layers to enable adjustment of the damping effects upon setting the bias of the acoustic material 14 and the thickness of the acoustic material 14 freely. Moreover, since a space in which the acoustic material 14 is packed is provided in the upstream part of the fuel nozzle 3, there is no risk that the flow of the air for combustion will be impeded.

[0019] The acoustic material 14 with the porous plate 15 is also attached to the inside of the casing 2 by means of a bolt 17, nut 18, and washer 19 (Figure 4).

[0020] As described above, the acoustic material 14 is attached to the inside of the casing 2 on the upstream side of the fuel nozzle 3, whereby damping of the place of combustion is increased due to the acoustic material 14 even at conditions where combustion vibration occurs by a combustion device not filled with this acoustic material 14; hence, the combustion vibration energy can be absorbed and dampened.

[0021] Accordingly, in the combustor in Figure 1, a reduction in the combustion vibration and enlargement of the operating range are enabled. Of course alteration of the type and thickness of the acoustic material 14 (glass wool, rock wool, etc.) is easy.

[0022] Although the present invention was described above on the basis of the illustrative embodiments, the present invention is not restricted by these embodiments, and needless to say, various modifications of the specific structure and configuration thereof can be added within the scope of the present invention disclosed in the Claims.

[0023] For example, according to the embodiments above, the acoustic material 14 was attached to the ceiling of the casing 2, but the position where the acoustic material is attached is not

restricted thereto and it can be appropriately selected as long as a space is secured inside the casing 2.

[0024]

[Advantages of the Invention] As described above, the present invention provides a combustor in which a pipe surrounding the upstream side of a fuel nozzle is provided, the space between that pipe and the fuel nozzle is filled with an acoustic material, and the acoustic material is provided on the inside face of a structure forming an air flow pass for combustion surrounding the circumference of the combustor, thereby effectively absorbing combustion vibration energy by the acoustic material, and as shown in Figure 5, reducing that energy.

[0025] In addition, according to the present invention, by using an acoustic material composed of at least one layer of acoustic material held by a porous plate, scattering of this acoustic material is prevented, and at the same time, assembly thereof is easy.

[Brief Description of the Drawings]

[Figure 1] A cross section of the vicinity of the combustor in a gas turbine equipped with the combustor according to an embodiment of the present invention.

[Figure 2] A cross section along line A-A in Figure 1.

[Figure 3] An explanatory diagram showing a configuration of an acoustic material employed in the combustor in Figure 1.

[Figure 4] A cross section depicting an enlarged portion of the casing in Figure 1.

[Figure 5] An explanatory diagram depicting the combustion vibration dampened state according to the present invention.

[Figure 6] An explanatory diagram of the vicinity of the combustor in a gas turbine equipped with a conventional combustor.

[Explanation of the Reference Numerals]

1: combustor

2: casing

3: fuel nozzle

4: inner tube

5: tail tube

6: outer tube

7: bypass elbow

8: bypass valve

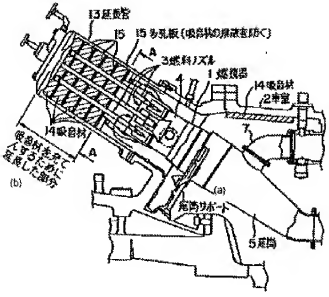
9: bypass valve variable mechanism

10: air compressor

11: air compressor discharge air

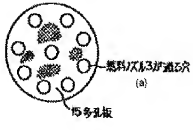
12: gas turbine

[Figure 1]



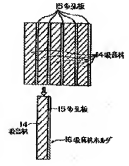
Key: (13) extended pipe; (15) porous plate (prevents scattering of acoustic material); (3) fuel nozzle; (1) combustor; (14) acoustic material; (2) casing; (5) tail tube; (a) tail tube support: (14) acoustic material; (b) extended part for packing acoustic material

[Figure 2]



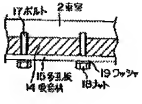
Key: (a) hole through which fuel nozzle 3 passes; (15) porous plate

[Figure 3]



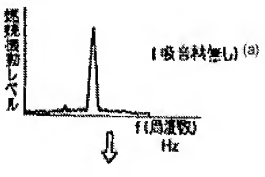
Key: (15) porous plate; (14) acoustic material; (16) acoustic material holder

[Figure 4]

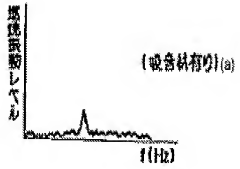


Key: (17) bolt; (2) casing; (14) acoustic material; (15) porous plate; (18) nut; (19) washer

[Figure 5]

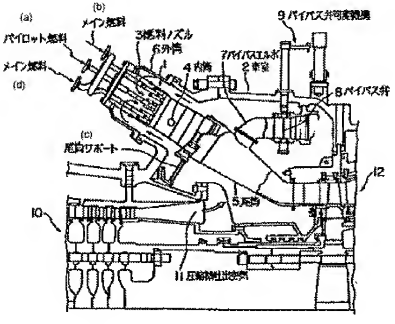


Key: (a) (no acoustic material); (x-axis) f (frequency) Hz; (y-axis) Combustion Vibration Energy



Key: (a) (acoustic material present); (y-axis) Combustion Vibration Energy

[Figure 6]



Key: (a) pilot fuel; (b) main fuel; (3) fuel nozzle; (6) outer tube; (4) inner tube; (7) bypass elbow; (2) casing; (9) bypass valve variable mechanism; (8) bypass valve; (5) tail tube; (11) compressor discharge air; (c) tail tube support; (d) main fuel